

SOME CONSIDERATIONS ①

IN REGARD TO

ACUTE OBSTRUCTIVE DISEASES OF
THE LUNGS,

BY

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6

SOME CONSIDERATIONS IN REGARD TO ACUTE OBSTRUCTIVE DISEASES OF THE LUNGS.*

WHENEVER there is obstruction of the pulmonary circulation, the labor of the right heart is necessarily increased. In proportion to its inability to overcome the obstruction, there will be an accumulation of blood in the venous system. Excess of blood in the veins implies deficiency in the arteries, and hence this class of affections is characterized by an unequal division of the blood between the venous circulation and the arterial.

This condition has extremely important consequences, especially in acute pulmonary affections. In these we study the pulse with the greatest solicitude to judge how the heart, as we say, is supporting the struggle. But the arterial pulse gives no indication of the immediate peril, for it is not the left heart that is bearing the brunt of the battle. The pulse tells its story only at second-hand. It may be small and weak, but it is chiefly because the left heart does not receive enough blood from the lungs to fill its chambers and to distend the arteries.

The trouble is not in lack of propelling power so much as in deficiency of blood to be propelled.

But if, instead of feeling the radial pulse, we could lay our finger upon the pulmonary artery, we should obtain information vastly more to the point. We should then be able to appreciate the degree of pulmonary obstruction by the fulness of the vessel, and to rate the power of the right ventricle by the force of the arterial beat. And in the relation of these two factors one to the other is involved the issue of the case. Increasing obstruction with decreasing right-heart power means death; decreasing obstruction with sustained right-heart power gives promise of recovery. It is a question with which the left heart, and therefore the radial pulse, has almost nothing to do. For the peril is not from general exhaustion, as for example in fever, nor from failure of the heart as a whole, as in some cases of infection, but specifically from tiring out of the

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right heart in its effort to unload the venous circulation through the obstructed vessels of the lungs.

Now, while we cannot place our finger upon the pulmonary artery, we can obtain nearly the same information by applying the stethoscope over the pulmonary valve. Owing to anatomical conditions which it is not necessary to describe, it is entirely practicable to separate the pulmonary valve-sounds from the aortic, and by means of auscultation to study the peculiarities of the former as indicating the condition of the pulmonary circulation.

Unfortunately, however, in some cases the valve-sound is masked by bronchial râles, so that it may be impossible to appreciate it accurately. But even in the most rapid breathing there are brief intervals during which the practised ear may nearly always gather the required information.

Now, if we note carefully the sound of the pulmonary valve in, for example, a case of pneumonia, we shall find that at the outset, while the right ventricle is still in vigorous action, this sound is especially clear and sharp, indicating a quick and strong recoil of the pulmonary artery following the ventricular systole. This sharp recoil is due to unusual distention of the vessel, and this in turn is due to the resistance which the blood meets in passing through the lungs.

If the case is to terminate favorably this accentuation of the pulmonary sound will probably continue through the whole course of the disease, becoming less marked as the obstruction in the lung decreases. But in cases of increasing severity, and with an unfavorable tendency, a time soon comes when not only this accentuation is lost, but the normal intensity of the valve-sound is lessened, the sound becoming weaker and weaker, until it ceases to be heard. This means, not that the obstruction has become less, but simply that the muscular power of the right ventricle has become exhausted with the labor exacted of it. The blood is no longer driven through the artery with sufficient force to distend it, and there is not enough recoil to bring the valve-cusps together with an audible sound.

When this point is reached, the end is not far off. The weakening of the right heart favors still greater pulmonary

obstruction, and this in turn adds to the burden of the right ventricle, thus completing the vicious circle. The struggles of the ventricle become feebler and feebler, while the tension within its cavity constantly increases, as the blood presses into it from behind. At last there comes a moment when the overtaxed muscle cannot summon the energy for another contraction, and its action ceases in diastole.

The steps which lead up to this result are in a great degree traceable by symptoms and physical signs. First of all, there are auscultatory and other signs of pulmonary obstruction ; then come signs of general venous congestion. The distended right auricle may be traceable by percussion, or even may be seen pulsating at the right of the sternum. An increased area of cardiac dulness extending toward the xiphoid cartilage indicates the repletion of the right ventricle, and in spare subjects the labored beating of this may be felt by pressing the fingers under the costal cartilages. The tense, hard pulse of inflammation is replaced by the small creeping pulse of arterial depletion. The superficial veins are seen to be unusually prominent, and the liver is enlarged. The spleen also is increased in size, and evidence of intestinal congestion may be afforded by copious diarrhœa.

Proof of passive hyperæmia of the kidneys is found in lessened excretion and in albuminuria. Thus all things combine to indicate a general preponderance of blood in the venous side of the circulation, the result which we should naturally expect from a retardation of the blood in the pulmonary vessels.

Now, what is the indication for treatment to be derived from this accumulation of blood in the venous system? Manifestly it is to diminish in every safe and proper way the disparity between the venous and the arterial supply. Formerly this was attempted by copious bleedings, which, however, were practised rather as a general antiphlogistic measure than with any exact notion of the mechanical conditions present. Certain it is, that the practice often resulted in at least temporary relief which was ascribed to subduing the inflammation. Withdrawing a large amount of blood from the venous system

naturally would bring relief to the congested lungs, and give a brief respite to the overworked right ventricle. In a certain proportion of cases this would be enough to bridge over a critical period, and I do not doubt that many cases were saved in those days by the lancet. Nor do I doubt that the entire abandonment of venesection at the present day is an excessive reaction from the sanguinary treatment of those diseases which was common in the early part of this century.

But in the majority of cases the beneficial effects of venesection can be obtained by other and less objectionable means.

Instead of diminishing the whole mass of the blood we can bring about a more even distribution of it between the venous and arterial systems, and thus relieve in a measure the engorgement of the former.

As preliminary, however, to the consideration of more direct means to this end, I would call attention to the importance of regulating the quantity and the quality of the diet in reference to the changed conditions of digestion and hæmatisis.

The anxiety "to keep up the strength" and the apprehension excited by the small and feeble radial pulse are apt to suggest the administration of more food than is necessary or beneficial. We forget that the digestive organs are not in a condition to do the work demanded of them in health, and also that the pulmonary obstruction interferes with the process of hæmatisis. Giving an excess of food therefore entails a double embarrassment. There is the burden arising from undigested food in the stomach giving rise to flatulent distention, and thus rendering respiration more difficult ; and there is also the risk of loading the blood with more nutritive material than the imperfect respiration can act upon in the process of sanguification. In regard to this latter point, I think it more important than it appears to generally have been regarded. We are too apt to consider only how much food can be digested and absorbed, and to overlook the fact that before the food so absorbed can really contribute to the sustenance of the body or add to the strength of the patient, it must undergo a process of assimilation, a process in which respiration plays an important part. The introduction into the venous current of more

nutritive material than can be fully acted upon through the agency of the respiration, not only fails to add to nutrition, but is a positive burden to the already overtaxed vital powers. Such excess must be thrown out of the system, and vital energy must be expended in getting rid of it; and meantime it is everywhere a hindrance to the vital functions.

Now it is precisely those alimentary substances which we would select on account of the ease with which they are digested and absorbed which for the same reason are most likely to be taken into the circulation in harmful excess. In this view it might even be better for the patient, if he must be overfed, that his food should be of a less digestible character, as the excess would do less harm in the alimentary canal than in the bloodvessels. We are apt to give freely of albuminous substances, and too often the instinctive craving for simple water to dilute the blood and facilitate its passage through the lungs is met by the constant proffer of milk, beef-tea, etc., in which the water is spoiled for nature's purpose by the addition of unnecessary food.

If then we find albumin in the urine we refer it to the congestion of the kidneys, instead of regarding it as an indication that the blood is surcharged with the products of digestion.

In view of these facts it becomes necessary to observe closely the effects of the nourishment given, and to assure ourselves, not only that the food is properly digested, but that it does not increase the embarrassment under which all the functions of the body, and especially the respiration, are laboring.

I am strongly of the opinion that if we study our cases closely with this in view we shall find more justification than we were prepared to admit for the very restricted diet which formerly was so much in vogue in the management of acute diseases of the respiratory organs. The danger here, let me repeat, is not from general exhaustion. It takes time to bring this about, as we see demonstrated even under the exhausting conditions of typhoid fever. But in the case before us the vital machine, as a whole, is *clogged*; it is only the right heart that is *exhausted*, and this not because it is underfed, but because it is overworked. Let us be watchful then, that the

nutriment we force upon the patient does not add at once to the clogging and the overwork.

But there is one form of food which is less liable than most others to defective assimilation, and this is alcohol. I say food advisedly, for, notwithstanding all that has been said to the contrary, I believe that in reasonable quantity it acts as such.

Alcohol is easily taken into the circulation, is easily oxidized, and any excess is readily disposed of by the emunctories, instead of remaining to embarrass the vital processes. Moreover, it retards tissue-change, and thus lessens the amount of carbon dioxide which the lungs are required to dispose of. The use of alcohol as a food in these cases is justified, therefore, as fully by its physiological action as by its chemical effects. But aside from its nutritive value, its stimulating action is of the greatest importance. Nothing else meets the indications so fully when depression of the nervous system is pronounced. Especially in pneumonia, when under the shock of the infection we find the patient delirious, with tremor and all the evidence of nervous exhaustion, the liberal use of alcohol is emphatically called for. But there is still another action of alcohol which, in my judgment, adds greatly to its value ; I refer to its power to relax the arterial system. And this brings us to the consideration of the class of medicines which are distinguished by this property. Chief among these are the nitrites, but the property is shared in a less degree by numerous other remedies and notably by aconite, the value of which in inflammatory diseases accompanied by high arterial tension is now universally admitted. It was in connection with this drug that the idea of "bleeding a patient into his own vessels" was first suggested, and the phrase well expresses the peculiar action of this class of medicines. By their specific effect either upon the vasomotor nerves or directly upon the muscular fibre of the vessels, they cause a relaxation of the muscular coat and a consequent dilatation of the whole arterial system. The change in capacity which may be effected in this manner is much greater than is generally believed. On this point Ringer says, "It has been shown that the vascular system is always in a state of

semi-contraction, and that by paralyzing the vaso-motor nerves it is possible to double its capacity." An effect much short of this would be sufficient to produce a vast difference in the dynamics of the circulation, and to afford a large measure of relief to the over-distended venous system.

It is in this way, I contend, that we should direct our efforts in cases involving pulmonary obstruction. I am aware that there is an opinion prevalent that these drugs are contra-indicated when there is feebleness of the heart's action ; and there are many practitioners who would regard, with a feeling akin to horror, the administration of nitro-glycerin, for example, when the pulse is notably small and frequent. If the condition broadly but vaguely described as heart-failure were thought to be impending, the administration of such a drug would be looked upon by them as a sort of *coup de grâce*. And so it might prove to be, if the feebleness of the pulse were due simply to general adynamia. But the case is altogether different when it is a mechanical rather than a vital condition we have to deal with. By increasing the capacity of the arteries we relieve the veins by exactly the amount of this increase. Lessening the pressure in the veins lessens *pari passu* the pressure in the pulmonary circulation, and with it the tumefaction of the mucous membrane and the tendency to exudation into the air-passages. Relief to the respiration and lightening of the labor of the right heart are the immediate consequence.

Now this is one of the results of the administration of alcohol. Its action upon the pulse in these cases is to make it large and soft ; in other words, to give it the character of a low-tension pulse, the so-called "brandy-pulse ;" and in this increase of arterial capacity lies, in my judgment, a large share of the value of this agent.

But we should not rest here. In urgent cases we should supply more powerful arterial relaxants, such as nitro-glycerin, and the potassium and sodium nitrites. Fraser has found nitro-glycerin extremely useful in relieving the dyspnœa in bronchitis, and he explains its action by assuming that there is in these cases a spasm of the bronchial tubes which is relieved by the drug. But the action on the vessels seems to me to

afford a much more probable explanation. Again and again I have seen a patient with pneumonia, somnolent or even comatose, with the face gray, the lips livid, the respiration superficial and from 50 to 60 per minute, and the chest everywhere full of moist râles, but nevertheless rescued from this apparently hopeless condition by drop doses of a one per cent. solution of nitro-glycerin administered every fifteen or thirty minutes. Here the theory of spasm could scarcely be entertained, but the relief comes from the transference of a mass of blood from the veins into the arteries.

The sodium or potassium nitrite has the advantage of producing a more enduring effect than nitro-glycerin, and may be found preferable on that account.

Digitalis is often given in this condition, but it seems to me to be clearly contra-indicated by its tendency to diminish the vascular area. Its action is to empty the arteries into the veins, whereas our effort should be to empty the veins into the arteries. Its administration proceeds upon the wrong assumption that the heart as a whole, and not the right heart alone, is in danger of exhaustion. Without giving any explanation of his observation, Loomis says that in pneumonia digitalis does more harm than good; and, barring exceptional conditions, I cordially agree with him. It cannot restore contractility to the paralyzed vessels of the affected part; on the contrary, it serves only to distend them more by increasing the tension in the unaffected vessels with which they communicate. The energy it imparts to the heart is in proportion to the muscular tissue acted upon, and, therefore, is twice as great on the left side as on the right. But the left heart has already an undue advantage over its fellow, and only harm can come from further increasing the unequilibrium. Yet digitalis may do good in those cases of pneumonia marked by high temperature and great nervous exhaustion, and in which the condition is due to the intensity of the infection, and not to pulmonary obstruction. Here the heart as a whole is in danger of failing, and the tonic property of the digitalis may be of essential service.

Much benefit may be derived in some cases of pulmonary obstruction from the inhalation of oxygen gas. It is not only

that the aëration of the blood is improved for the time being, but the pulmonary circulation is facilitated by this improvement. This is shown in pulmonary œdema, or, still more notably, in bronchitis, in the speedy decrease in the moist râles which often follows the inhalation of the gas. The influence of asphyxia in obstructing the pulmonary circulation is an elementary fact in pathology, and is exemplified in a less degree in the class of cases we are considering. Here again a vicious circle exists: congestion and effusion prevent proper aëration of the blood; imperfect aëration of the blood aggravates congestion and effusion. This circle is broken with the breaking of either of the segments of which it is composed. We strike at the congestion when we administer vaso-dilators; and at the imperfect aëration when we give inhalations of oxygen. A combination of the two methods will be successful in a considerable number of apparently desperate cases.

Finally, there are certain mechanical expedients to which we may resort before we abandon all hope of relieving the patient. One of these is artificial respiration. Just as the right heart becomes fagged by the unusual labor demanded of it, so the respiratory muscles become wearied out by the heavy task imposed upon them. But more serious than the muscular fatigue which interferes with inspiration is the sodden and inelastic condition of the lung, which hinders its retraction in expiration. The result of the combined conditions is an exceedingly superficial and, therefore, very frequent breathing, which rapidly exhausts the remaining strength.

Artificial respiration may do much, where this is the case, to supplement the efforts of the patient. It is best performed by two persons, one of whom draws the arms steadily upward over the head until the maximum of inspiration is obtained, when, the traction being relaxed, the other presses with both hands firmly upon the lower part of the chest in a direction backward and toward the median line, thus diminishing both the depth and breadth of the thorax. This latter manœuvre may result in the expulsion of froth from the nose and mouth, which should be wiped away before the pressure on the chest is relaxed. By alternating these movements, not only will a

greater amount of air be taken into the lungs, but a considerable quantity of mucus, etc., may be removed. At the same time the assistance to the circulation which the respiratory movements naturally afford will be imitated, and the intrathoracic vessels will be relieved of some of the blood with which they are distended.

In a certain proportion of cases the relief obtained by this aid to respiration will tide over a critical period.

Still another mechanical expedient may be resorted to in an emergency. This is placing ligatures about the limbs sufficiently tight to interrupt the return of the venous blood. This, for the time being, is equivalent to a venesection, but the danger of inducing thrombosis must not be lost sight of. This may be lessened, if not avoided, by tying up and releasing the several limbs in succession.

RECAPITULATION.

1. In acute pulmonary obstruction, the danger being from exhaustion of the right heart, the pulse at the wrist does not give reliable indications as to the gravity of the condition.

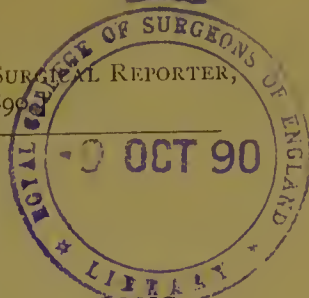
2. This can be appreciated more correctly by studying the pulmonary circulation by the aid of the pulmonary valve-sound.

3. Marked accentuation of the pulmonary valve-sound indicates a fairly-vigorous right heart laboring to overcome resistance in the pulmonary circulation.

4. Decrease of a previously existing accentuation with only moderate dyspnœa indicates decrease of pulmonary obstruction.

5. Decrease of accentuation with increase of respiratory distress indicates that the right heart is becoming exhausted.

6. Relief is to be sought : *a*, by regulating the diet in conformity with the diminished power of digestion and sanguification ; *b*, by the use of medicines which dilate the arteries and promote transference of blood to them from the veins ; *c*, by the inhalation of oxygen gas ; *d*, by artificial respiration ; *e*, by placing ligatures about the extremities in order to retain the blood in them and prevent its return to the heart.



PREVENTIVE INOCULATIONS AGAINST TUBERCULOSIS.

At the recent meeting of the International Medical Congress, in Berlin, Dr. Robert Koch made an address in which he asserted that he had discovered a method by which animals ordinarily very susceptible to contract tuberculosis from inoculations of the bacillus were made capable of resisting such inoculations. The details of his method he did not make public. Stimulated apparently by this announcement, which is calculated to attract widespread attention, Drs. Grancher and Martin, of Paris, announced in the *Bulletin Médical*, August 20, 1890, that they also had devised a method by which these results could be obtained.

In this number of the REPORTER Professor Samuel G. Dixon, of Philadelphia, presents a short article in which attention is called to the fact that a year ago—October 19, 1889—he had proposed the lines upon which preventive inoculations against tuberculosis might be expected to be successfully carried out, and that he had already succeeded in a certain number of instances in producing immunity against the disease in animals. This announcement antedates by so much the announcements of Koch, and Grancher and Martin, that American medical men must feel an interest in maintaining the priority which belongs to this country.

In this particular matter it may be pointed out that Dr. Dixon in his announcement gives some indications as to the method by which he obtains the attenuated virus used in his experiments. Intimations of this sort are totally lacking in the communications of Koch, Grancher and Martin.

